Survey on an Ad-Hoc Network based Congestion Control Mechanism for TCP Vegas

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ABSTRACT
The wireless communication TCP protocol is an important role in developing communication systems and which provides better and reliable communication capabilities in almost all kinds of networking environment.

Vegas is much better in performance as compare to other TCP variants like TCP Reno and new Reno because of its packet delivery ratio and full use of packet transmission bandwidth. Parameters like throughput and transmission delay plays a vital role in Vegas performance. In this paper I have surveyed TCP Congestion Control Algorithms and their performance on Mobile Ad-hoc Networks (MANET). More specifically, I observed the performance behavior of BIC, Cubic, TCP Compound, Vegas, Reno and Westwood congestion control algorithms. ICATCP is proposed to deal with the problem of real achievable throughput of whole network and online congestion control.

Keywords
Ad-Hoc Network, Congestion Control Mechanism

1. INTRODUCTION
TCP Vegas is known for its stable and brilliant congestion control capabilities. There are many more competitive versions of TCP like Westwood plus, Reno but TCP Vegas provides high throughput with minimum loss of packets. It is developed by Brakmo and Peterson in 1992. Vegas is more reliable because it provides congestion control before collision in ad hoc networks.

In mobile ad hoc networks, Vegas performance is better than other TCP versions at three aspects-

1. RTT (Round trip time) is prepared for the later prediction of throughput.
2. Vegas halves the congestion window (cwnd) size by identifying difference between expected throughput and actual throughput.
3. Vegas emphasize packet delay instead of packet loss by calculating transmission rate.

Vegas only calculate the expected throughput by using round trip time of TCP layer. It cannot reflect the real throughput of whole network. Based on network situation of previous time step, Vegas change its congestion window. It gives idea of how to improve the whole network performance by future prediction of throughput. Improved Congestion Avoidance TCP (ICATCP) is a model which proposed to deal with the problem of real achievable throughput of whole network and online congestion control.

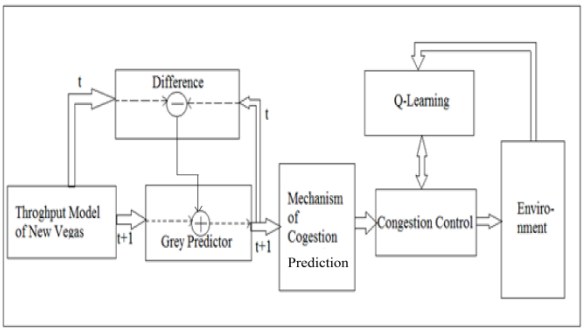

Fig : ICATCP Model

ICATCP Vegas has been proposed by researchers which has three enhanced views in congestion avoidance stages -

A. Throughput model to improve the theoretical throughput.

B. Grey prediction based on forward throughput prediction mechanism is used to promote the online cwnd control.

C. Q-learning is applied to search more reasonable changing size of congestion window.

The results show that the ICATCP has lower delay, higher throughput and more fair allocation of bandwidth in multi-hops ad hoc scenarios.

2. TCP VEGAS
In TCP Vegas, timeouts are set and round-trip delays are measured for every packet in the transmit buffer. TCP Vegas increases in the congestion window.

Vegas is a TCP congestion avoidance algorithm that emphasizes packet delay rather than packet loss. Vegas detects congestion based on increasing round-trip time values of the packets in the connection like Reno, new Reno etc. which detect congestion only after it has actually happened via packet drops. The algorithm depends heavily on calculation of the base round-trip time value. If it is small then throughput will be less than bandwidth available and vice-versa.

Vegas deploy a different congestion avoidance mechanism. This mechanism helps to estimate the level of network congestion before happening and tries to avoid it. Its decision is based on throughput measurements per round-trip time. Hence, Vegas calculate the difference between the actual rate (packets sent per round-trip time) and the expected rate (packet sent per best round-trip time) at the sender. If it is less than threshold then it is an indication that the network resources are under-utilized and it increases its window by one segment. If the difference is greater than threshold then it is signifies that the network receive congestion and it decreases its window size by one segment to prevent it.

Otherwise, it keeps its congestion window same. By avoiding congestion and the unnecessary retransmissions of dropped packets, Vegas help to use of the available bandwidth more efficiently.

3. RELATED WORK

Better output can be achieved using TCP Vegas. Also TCP Vegas provides prominent and effective results than other available competitive versions like Reno and New Reno. It has been measured three TCP versions using ns2 simulation software in the mobile ad hoc network. It has been proved that packet delivery ratio using TCP Vegas is much better than other variants. [1]

There are six TCP variants namely BIC, Cubic, TCP Compound, Vegas, Reno and Westwood congestion control algorithms. Comparison between these six different TCP standard congestion control algorithms is done. These six standard congestion control algorithms are mostly used in several standard systems. Some extra parameters are applied while measuring the performance of these algorithms namely Fast Recovery, Congestion Avoidance, Slow Start etc. The comparison of the performances of each algorithm is evaluated using ns2 software and suitable measuring criteria are applied to get the proper comparison results. Conclusion is Vegas is the only algorithm which provides impressive and desired results like throughput of Vegas is stable and excellent all over the time as compared to BIC algorithm which provides good output after 75 seconds. It also concludes that Vegas is best suitable for small and active mobile ad hoc network. [2]

There are five different TCP variants on the basis of their performance characteristics. Five TCP variants includes Vegas, New Reno, Reno, Westwood and BIC. The performance comparison result would decide which TCP variant is more sustainable and capable to avoid diverse conditions on WiMax network. It concentrates on the effect of suitable TCP variants on various adverse conditions of WiMax networks like link congestions, asymmetric end to end capabilities, wireless errors etc. [3]

It has evaluated that TCP Vegas performance in large bandwidth and large delay network condition using ns2 tool. Standard default parameters used in TCP Vegas does not produce competitive performance in congestion control window as compared to other TCP variants. But it is observed and analyzed two parameters, alpha and beta play an important role in improving the Vegas performance considerably. Variation in these parameters while configuring the congestion window gives wide range of results. [4]

Markov Decision Process is formulated to determine TCP Vegas performance. Several extensive illustrations have been performed to conclude that lower layer factor adjustments can a way to optimize the problem of throughput. Cross layer techniques plays a vital role in optimizing the TCP Vegas performance. It also has been evaluated that segment loss probability plays a key role in a multi-hop scenario because of the increased path length which leads to a significant increase of segment loss probability. [5]

It has proposed that bandwidth estimation scheme which estimates the overall bandwidth for TCP traffic over 802.11WLANs. Extensive NS2 illustration results show that this algorithm provides higher accurate bandwidth estimations with increasing number of nodes. The proposed bandwidth estimation algorithm can also be extended for IEEE 802.11e and IEEE 802.11p. It also illustrates that there is 95% confidence level that no significant differences can be found in proposed algorithm and actual simulation. [6]

It has illustrated that a new technique "Accurate Bandwidth Reservation - ABR" for bandwidth reservation in mobile ad hoc network. ABR improves existing approach of bandwidth estimation techniques on wireless links. ABR increases the correctness of available bandwidth estimation by considering each wireless 802.11 ad hoc network criteria as the overlap of the channel idle periods, mobility and collisions. [7]

A simple and accurate model has been evaluated to estimate the throughput of a Vegas flow as a function of packet loss rate, average round trip time, minimum observed round trip time and protocol parameters alpha, beta. [8]

There are many problems associated with TCP Vegas and proposed modifications to the congestion avoidance algorithm of TCP Vegas to overcome the problems. Proposed modification, TCP Vegas-A was performed better than TCP Reno in both wired and satellite networks. It has been simulated that TCP Vegas-A is able to compete better against TCP New Reno. It overcome rerouting conditions in wired and fluctuating RTT in satellite networks and overcome bias against high bandwidth and older connections while at the same time retaining the useful properties of TCP Vegas. [9]

4. CONCLUSION

I have studied several variants of TCP and compare the performance parameters such as throughput, transmission delay, bandwidth reservation etc and come to the conclusion that TCP Vegas is the only algorithm which provides impressive and desired results as compare to other TCP variants such as throughput of Vegas is stable and excellent all over the run time. It is also observed that NS2 simulation tool is the best way to illustrate and measure the performance of Vegas in ad hoc network.

5. REFERENCES

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